

## CLAIMS

- 1 1. A method for enabling a server configured with a plurality of virtual servers to par-  
 2 ticipate in a plurality of private network address spaces and service requests within those  
 3 address spaces, the method comprising the steps of:  
 4        associating each virtual server with an IPspace having one or more addresses as-  
 5 signed to one or more network interfaces of the virtual server;  
 6        tagging each network interface with a first IPspace identifier (ID);  
 7        providing the virtual server with one or more routing tables that control routing  
 8 operations for requests processed by the virtual server; and  
 9        applying the first IPspace ID to translation procedures that enable selection of a  
 10 current virtual server context used to process an incoming request and an appropriate  
 11 routing table used to process an outgoing request.
- 1 2. The method of Claim 1 wherein the server is a filer and wherein the virtual server is a  
 2 virtual filer (vfiler).
- 1 3. The method of Claim 2 wherein the step of applying comprises the step of employing  
 2 an incoming path translation procedure.
- 1 4. The method of Claim 3 wherein the step of employing comprises the steps of:  
 2        receiving the incoming request at the network interface, the incoming request hav-  
 3 ing a destination address;  
 4        searching a list of addresses contained in an interface network structure for an ad-  
 5 dress that matches the destination address of the incoming request, the interface network  
 6 structure storing the first IPspace ID; and  
 7        upon finding a match, following a first pointer of the interface network structure  
 8 to an interface address structure having a back link pointer that references a vfiler context  
 9 structure storing a second IPspace ID.

1 5. The method of Claim 4 wherein the step of employing further comprises the steps of:  
2 comparing the first IPspace ID with the second IPspace ID; and  
3 selecting the current vfiler context to process the incoming request when the first  
4 IPspace ID matches the second IPspace ID.

1 6. The method of Claim 5 wherein the step of employing further comprises the step of  
2 configuring a second pointer of a process block data structure to reference the current  
3 vfiler context to thereby qualify the request for subsequent processing in the filer.

1 7. The method of Claim 6 wherein the subsequent processing comprises one of searches  
2 and boundary checks needed to verify that the vfiler is allowed to access requested stor-  
3 age resources.

1 8. The method of Claim 3 wherein the step of applying comprises the step of employing  
2 an outgoing path translation procedure.

1 9. The method of Claim 8 wherein the step of employing comprises the steps of:  
2 issuing the outgoing request from a vfiler;  
3 determining whether the request requires route calculation; and  
4 if route calculation is required, using a routing table pointer of the current vfiler  
5 context to choose the appropriate routing table of the vfiler to process the outgoing re-  
6 quest.

1 10. The method of Claim 9 wherein the step of choosing comprises the steps of:  
2 performing a lookup operation to the appropriate routing table;  
3 determining over which output interface the outgoing request should be for-  
4 warding; and  
5 forwarding the request to the output interface.

1 11. A system adapted to enable a file server configured with a plurality of virtual servers  
2 to participate in a plurality of private network address spaces and service requests within  
3 those address spaces, the system comprising:

4 a network adapter including at least one network interface configured to receive  
5 an incoming request from the network and to forward an outgoing request over the net-  
6 work, the network interface an address and having a first IPspace identifier (ID) that  
7 binds the interface to an IPspace;

8 a plurality of routing tables maintained by the virtual servers to control routing  
9 operations for requests processed by the virtual servers;

10 an operating system comprising networking code that uses a destination address  
11 of the incoming request and the first IPspace ID to select a current virtual server to proc-  
12 ess the incoming request, the networking code further using a routing table pointer of the  
13 current virtual server to select an appropriate routing table if a routing operation is re-  
14 quired for the outgoing request; and

15 a processor coupled to the network adapter and configured to execute the operat-  
16 ing system to thereby invoke network and storage access operations in accordance with  
17 translation procedures associated with incoming and outgoing requests.

1 12. The system of Claim 11 wherein the file server is a filer and wherein the virtual serv-  
2 ers are virtual filers (vfilers).

1 13. The system of Claim 12 wherein the operating system is a storage operating system.

1 14. The system of Claim 13 further comprising a memory adapted to maintain various  
2 data structures that cooperate to provide an IPspace database that stores configuration in-  
3 formation used to select the current vfiler.

1 15. The system of Claim 14 wherein the various data structures comprise:

2 an interface network (ifnet) structure associated with the network interface;

an interface address (ifaddr) structure coupled to the ifnet structure and representing the address of the interface;

a vfiler context structure coupled to the ifaddr structure; and

a process block (proc) structure coupled to the vfiler context structure.

16. The system of Claim 15 wherein the ifnet structure includes configuration information such as a first pointer referencing the ifaddr structure for the address assigned to the network interface and the first IPspace ID of the interface.

17. The system of Claim 16 wherein the ifaddr data structure includes a back link pointer that references the vfiler context structure associated with the address.

18. The system of Claim 17 wherein the vfiler context structure contains configuration information needed to establish the current vfiler, the configuration information including a second IPspace ID and the routing table pointer.

19. The system of Claim 18 wherein the proc data structure represents a context of a process thread executing on the filer and contains a second pointer referencing the current vfiler.

20. Apparatus for enabling a filer configured with a plurality of virtual filers (vfilers) to participate in a plurality of private network address spaces and service requests within those address spaces, the apparatus comprising:

means for associating each vfiler with an IPspace having one or more addresses assigned to one or more network interfaces of the vfiler;

means for tagging each network interface with a first IPspace identifier (ID);

means for providing the vfiler with one or more routing tables that control routing operations for requests processed by the vfiler; and

9 means for applying the first IPspace ID to translation procedures that enable se-  
10 lection of a current vfiler context used to process an incoming request and an appropriate  
11 routing table used to process an outgoing request.

1 21. A computer readable medium containing executable program instructions for ena-  
2 bling a filer configured with a plurality of virtual filers (vfilers) to participate in a plural-  
3 ity of private network address spaces and service requests within those address spaces,  
4 the executable program instructions comprising program instructions for:  
5 associating each vfiler with an IPspace having one or more addresses assigned to  
6 one or more network interfaces of the vfiler;  
7 tagging each network interface with a first IPspace identifier (ID);  
8 providing the vfiler with one or more routing tables that control routing operations  
9 for requests processed by the vfiler; and  
10 applying the first IPspace ID to translation procedures that enable selection of a  
11 current vfiler context used to process an incoming request and an appropriate routing ta-  
12 ble used to process an outgoing request.